# Image Analysis and Pattern Recognition in Geological Mapping

## 22-26 May, 2017

### School of Geosciences, University of the Witwatersrand

Many users of remotely sensed data spend much of their time in processing an image, as if an attractive image provides the solution to the problem that they are addressing. Working with remotely sensed data, however, goes beyond image enhancement. Whilst desirable, it is not always possible to significantly enhance the image (what you have is what you get), yet the image still has to be interpreted using specific image interpretation criteria. This **5-day course** is designed for those who wish to master the science that goes behind image analysis and pattern recognition related to geological features. Questions to be addressed include: *How do I extract lithological units? How do I determine the lithological sequence? How do I determine the dip and strike of the rocks? Is the topomap adequate for extracting the structural elements (faults, folds, bedding traces or foliation traces)? Can I improve the interpretation of the structure geology of the area? Can I improve the descriptive geometry of structural features? Does the spatial data reveal fault mechanics?* These and many other issues are critical for geologists trying to solve exploration geological problems from satellite data, as analysis of remote sensing data is now a tool, but also a pre-requisite, for a geologist before undertaking fieldwork.The course will be based on the new **Copernicus Sentinel 1 and 2** imagery because of their spectral and spatial components and because the data are freely available to download. Participants will be introduced first to basic and advanced image processing techniques. The course will then focus to pattern recognition of lithological and structural elements where the participants will interpret the images and integrate the various datasets in a GIS environment and compare their results with validated data (originating from field practices).

## Course content

| Day 1 | Content Details | |
|---|---|---|
| *09:00-17:00* | **Lecture 1:** *Introduction to past, current and future sensors; Introduction to Sentinel 1 (Radar) and Sentinel 2 (Optical) Remote Sensing and their specifications; Image processing and enhancement techniques applied in geological applications to date (Image transformation, texture analysis, image classification, etc ).* | *Theory* |
| **Day 2** | | |
| *09:00-10:30* | **Lecture 3:** *Lithological and Structural Pattern Recognition techniques* | |
| *11:00-12:30* | **Practical Exercise 1:** *Acquisition of Sentinel data – optical and radar data* | *Practical Exercises* |
| *13:30-17:00* | **Practical Exercise 2:** *Sentinel 2: Image data processing & visualization: image sharpening, PCA, MNF transformation, decorrelation stretch,,ratioing, filtering,etc.* | |
| **Day 3** | | |
| *09:00-15:00* | **Practical Exercise 2:** *Sentinel 2: Image data processing & visualization: image sharpening, PCA, MNF transformation, decorrelation stretch, ratioing, filtering,**etc.*** | |
| *15:30-17:00* | **Practical Exercise 2:** *Sentinel 1: slant-ground range conversion, image registration* | |
| **Day 4** | | |
| *09:00-17:00* | **Practical Exercise 3:** *Data interpretation; Lithological and Structural Interpretation in a GIS Environment* | |
| **Day 5** | | |
| *09:00-15:00* | **Practical Exercise 3:** *Data integration; Lithological and Structural Interpretation in a GIS Environment* | |
| *15:30-17:00* | **Discussion** | |

## About the Presenter

Prof. Tsehaie Woldai is an internationally-renowned Remote Sensing and GIS specialist who spent more than 30 years at the International Institute for Geoinformation and Earth Sciences (ITC) in The Netherlands. He is currently a Visiting Professor at the University of the Witwatersrand. His research interests include geology, structural geology, remote sensing (Optical, Synthetic Aperture Radar (SAR), Interferometric SAR, Hyperspectral), image processing and interpretation, GIS and geo-environmental modelling and ranges across all continents except Antarctica. He has published more than 100 papers and has presented more than 50 short courses across the world. Owing to popular request, this is a continuation of Prof. Woldai's series of courses held at Wits.

## Who should attend?

The course is open to Earth Scientists employed in mining companies, Geological Survey organisations, universities and other organisations, who are engaged in geological mapping or in mineral exploration. **It can accommodate a maximum of 25 participants**. Prior experience of remote sensing would be useful but is not a requirement for people interested in attending the course. Participants wishing to bring their own laptops and ENVI software are welcome to do so.

## Course fee

The fee of **R9.500.00 (+ 14% VAT)** includes all notes and morning and afternoon tea/coffee. A variety of lunch options are available on campus. Parking will be arranged.

## Application deadline:

Please complete the attached Registration Application Form **before 12 May, 2017**, and return it to Rayline Karim (rayline.karim@wits.ac.za; 011-7176547; Fax 011-7176579). Approved candidates will be notified by 15 May.

## Venue

GIS Laboratory, Bernard Price Building, East Campus, University of the Witwatersrand, Johannesburg

## *Registration Application Form*

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**Please return completed form by e-mail to <u>rayline.karim@wits.ac.za</u>, or fax to 011 717 6579**

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| **Title:** | |
| **First Name:** | |
| **Surname:** | |
| **Organisation:** | |
| **Position:** | |
| **Address:** | |
| **Invoice details (if different from above)** | |
| **Vehicle Registration Number** | |
| **Telephone Number:** | |
| **Cell Phone Number:** | |
| **Fax Number:** | |
| **E-Mail Address:** | |
| **I have attended the following Image Processing courses / I have the following relevant experience:**<br><br>**(As this is an advanced course, please provide details that demonstrate your proficiency, such as course name, duration, venue, presenter/organisation. This information will be used for selection purposes)** | |

**<span style="color:red">Application Deadline is Friday 12 May; approved candidates will be notified of acceptance by 15 May, 2017, and will receive payment details.</span>**